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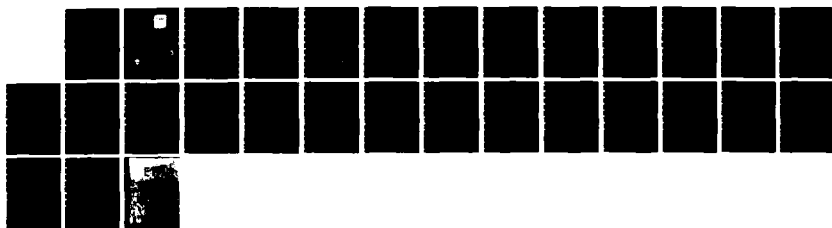
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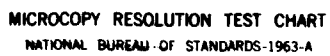
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# STUDENT ESSAY

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## TECHNOLOGY TRANSFER DICHOTOMIES

BY

COLONEL HOWARD C. RACE  
23 DECEMBER 1983

CORRESPONDING COURSE

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personnel in the government lab, industrial R&D center, and the university research facility must be delineated, and guidance provided on how to separate classified information from unclassified militarily significant technology, and from other unclassified technology information. The active participant role for the technical "subject matter expert" is necessary to accomplish national security objectives through encouraging domestic technology transfer and preparing accurate technology assessments for considerations in export control case processing.

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## ABSTRACT/INTRODUCTION

Domestic Technology Transfer is the positive exchange of information among the members of the scientific and engineering communities within the US, both defense and non-defense related. Technology export can be intentional or non-intentional, and the results can produce strategic benefits/detriments to the nation's economic, political, and military goals. The dichotomy and the dynamics of the national policies and directives on these two aspects of technology transfer are frequently discussed. The roles of personnel in the government lab, industrial R&D center, and the university research facility must be delineated, and guidance provided on how to separate classified information from unclassified militarily significant technology, and from other unclassified technology information. The active participant role for the technical "subject matter expert" is necessary to accomplish national security objectives through encouraging domestic technology transfer and preparing accurate technology assessments for considerations in export control case processing.

## TECHNOLOGY TRANSFER DICHOTOMIES

### The Three Faces of Technology Transfer

Technology transfer means different things to many people.

Sometimes technology transfer means the rational progressive movement or hand-off of technology from basic research (6.1) to exploratory development (6.2), to advanced development (6.3a and b), to engineering development (6.4), and to the acquisition, fielding and life cycle support of military equipment. "Technology infusion" is also an integral part of logistics R&D, integrated logistics support, manufacturing methods and technology, and pre-planned product improvements.

Secondly, technology transfer has been understood to be the positive exchange of scientific, technical, engineering, and manufacturing data and know-how among and within academia, industry, and Government agencies to the enhancement and growth in the overall body of knowledge. Benefits are accrued by harnessing the laws of physics and science for mankind. Economic benefits are obtained by competitive industry in the marketing of new and innovative products that push the state-of-the-art. Increased sophistication in technology also allows the military-industrial complex to develop new and improved capability weapons and equipment to support the nation's fighting forces.

Thirdly, technology transfer has become the dominant phrase when concerned with the loss of technology across our borders which may result in a detrimental impact to our national defense posture and cause reductions in our industries' economic well being.

## The Dichotomy

Technology advancements are known to produce an increase in a nation's economic prosperity, while at the same time improving its military preparedness either directly or indirectly. Obviously the United States wants to maximize domestic technology transfer and manage or control the export of all technology to our Allies and friendly non-aligned nations. That will assure our favorable economic position in the world market, and/or enhance our Allies' military stature for the overall benefit of the free world. Likewise, we want to minimize technology export to our potential adversaries to maintain, gain, or regain economic and/or military advantages. Unless, of course, there is a political decision that would have us make a purposeful technology export for a particular reason. It must be kept in mind that the US may not be the world leader in all fields of science and engineering and that intentional technology export could yield a beneficial reciprocal technology import.

The technology transfer controversy arises over Government control of military hardware/software and technical data related to science, technology, research, development, manufacturing, test, operation, and maintenance of weapons/munitions and military equipment. For obvious national security reasons some of this information is classified, and some is not. Some of the generally unclassified information has been labeled as "militarily critical technology" and subject to export control laws. Clouding the issue is the fact that some

technology has a "dual-use" (both military and non-military application), and that means the "end-use" abroad may be in question. One of the most prominent questions surrounds the position that governmental control of basic research technologies is contrary to the established "openness" atmosphere in the United States academic arena. Similarly, US industry is concerned about corporate profits that may be maximized in the world market place by the sale of their goods and services -- both military and commercial. Industry is frequently perturbed by excessive delays and inconsistencies in processing munitions control cases and the voluminosity of the Militarily Critical Technologies List (MCTL).

## The Holes in the Dike

The body of US scientific and technical knowledge is analogous to the water in a reservoir. The US is continually trying to build up its capacity through positive contributions while limiting the uncontrolled discharge and leaks. Our open society affords friends and foes alike the opportunities to obtain scientific knowledge just for the asking, for a fair price, and by less than honorable means. Specifically why do potential adversaries want our technology?

The Soviets and their Warsaw Pact Allies have derived significant military gains from their acquisitions of Western technology, particularly in the strategic, aircraft, naval, tactical, microelectronics, and computer areas. This multifaceted Soviet acquisitions program has allowed the Soviets to:

- Save hundreds of millions of dollars in R&D costs, and years in R&D development leadtime...
- Modernize critical sectors of their military industry and reduce engineering risks by following or copying proven Western designs, thereby limiting the rise in their military production costs.
- Achieve greater weapons performance than if they had to rely solely on their own technology.
- Incorporate countermeasures to Western weapons early in the development of their own weapon programs.

These gains are evident in all areas of military weapons systems.

Potential technology transfer channels can be categorized as overt (lawful, political, economic) or covert (less than honorable). The quality and quantity of the technology transferred (exported) can vary tremendously as can the level of public knowledge (the cognizance of the victim).

In the unclassified CIA report, "Soviet Acquisition of Western Technology," which is favorably accepted throughout the executive and legislative branches of the US Government, certain technologies and equipments are identified as projected Soviet technological needs and acquisition targets through the 1980's. They range from manufacturing and programming information for computers to propulsion systems technology and sensor systems technology.

## DOMESTIC TECHNOLOGY TRANSFER

### Non-Defense Technology Transfer Fundamentals

The nation's technological reservoir is filled by the basic scientific research conducted in our 150 research universities throughout the states. While the universities are basically educational institutions, they have taken on the role of research centers as an inseparable responsibility and necessity. The senior scientist professor and his graduate student apprentice frequently make original contributions to the research frontier. Today, the universities conduct more than one-half of the basic research in the country with only about 10% of the total R&D dollar. This body of knowledge is communicated in many different ways. Our scientists publish their findings in many of the over 2000 international technical journals. They attend scientific meetings and symposiums to present their findings and listen to their colleagues. They conduct daily and weekly less formal technical discussions with their fellow scientists, graduate students and other interested researchers both in the US and abroad.

These technical discourses on principally non-defense related subjects are, in many instances, transferred to industrial R&D centers and commercial engineering laboratories to become "productized" for consumer goods. Sometimes technological design and know-how is stamped "proprietary" by its owner and safeguarded with every facility available except maybe an armed guard. This proprietary information and its benefits

are held for timely disclosure to maximize sales potential and thus optimize corporate profits. The "bad guys" are the competition - both foreign and domestic. The market of today and the future belongs to the successful "secret keeper," with the right technical solution.

#### Governmental Stimuli to Technology Transfer

From the defense/industry/academia science and technology perspective, basic and applied research is performed in government laboratories and conducted for the government by defense contractors and in the university research facility.

The exchange of defense produced technology takes place through official Government publications, closed Government/contractor conferences or workshops, and restricted access symposiums sometimes co-sponsored by non-government organizations such as the American Defense Preparedness Association (ADPA) which support national defense objectives. Other written and verbal information about defense produced technologies is also transferred through scientific journals, open meetings, and symposiums just as for the non-defense technologies generated outside the Government. It is the law of the land and the Department of Defense (DoD) policy to provide the American people with the maximum information about DoD operations and activities. To this end there are many established Federal programs to effect dissemination of information among Government agencies and to the American public for the expressed purpose of enhancing our "technology quotient" and our military/economic well being.

## TECHNOLOGY QUOTIENT

The nation's Technology Quotient (T.Q.) is directly proportional to advances in technology and inversely proportional to technology loss to the adversaries.

$$T.Q. = \frac{\text{Technology Advances}}{\text{Technology Loss to Adversaries}}$$

The larger the T.Q. - the more secure the nation, militarily, economically, and politically.

### Information Programs

Execution of the DoD Scientific and Technical Information Program is accomplished by every technology producing DoD agency and by the Defense Logistics Agency (DLA) through its Defense Technical Information Center (DTIC) which is located at Cameron Station in Alexandria, Virginia. When a technical report is prepared by a DoD agency or defense contractor, it is given primary dissemination directly to other defense agencies and specific industrial/academic facilities known to be participating in the development of that specific defense related technology. Most documents are also placed in the repository of DTIC where their abstracts, titles, etc., are announced biweekly in the "Technical Abstract Bulletin (TAB)" to alert registered Government agencies and defense contractors of their existence and availability for secondary distribution. The TAB and its annual index are classified confidential. Authorized Government agencies can request copies of available reports directly from DTIC. To obtain "limited distribution" reports, defense contractors in the past initiated a request that required the concurrence of their sponsoring contracting officers' technical representative (COTR) (Government bench engineer) and approval of the report's originating agency. Two new distribution limitation statements will provide for rapid access by certified Government agency contractors and/or DoD contractors who have a generalized "need-to-know."

### Information Analysis Centers

To facilitate the acquisition and analysis of specific technical information in a narrow field, the Department of Defense has established 19 Information Analysis Centers (IAC'S). Some centers are organized along the discipline line, i.e: plastics, or metals; other centers have a mission area orientation, i.e: guidance and control, or infrared technology.

## Public Technical Information

Complementing the "DoD Community" Scientific and Technical Information Program is the Department of Commerce's National Technical Information Service (NTIS). The NTIS, located in Springfield, Virginia, receives all DoD technical publications that have been "approved for public release - distribution unlimited" and other US Government produced research development and engineering reports. Obviously this is an excellent domestic technology transfer mechanism for all Government agencies, American industry, university requirements and any American citizen. Of concern though, is the fact that while information in NTIS has been determined suitable for public release, the availability of this "cheap to obtain" technology can provide our friends and Allies economic advantages and can provide our potential adversaries an economic boost resulting indirectly in enhanced military capability. Even though this may be the case, Congress has established an "openness" policy on transfer of federally funded technology to state and local governments and to the private sector. It is interesting to note that the Soviet Embassy in Washington, DC, has a standing order for two copies of every report available from NTIS.

### Technology Innovation Act

In the Stevenson-Wydler Technology Innovation Act of 1980, the Congress mandated that all federally funded laboratories establish an Office of Research and Technology Applications (ORTA) "to provide and disseminate information on federally owned or originated products, processes, and services having a potential application to state and local government and to private industry." The act also required that the Department of Commerce establish a Center for the Utilization of Federal Technology (CUFT). The CUFT was institutionalized as a part of the NTIS. The dissemination process is initiated by the federally funded bench engineer who identifies that serendipitous utilization of his technology may be a solution to some problem in the state, local or private sector.

## The Freedom of Information Act

The Freedom of Information Act postulates that openness in Government is good, and that the American public has a right to know almost everything that the Government is doing. The act provides that nine categories of information or records may be withheld from public disclosure unless otherwise prescribed by law. Generally those exemption categories are:

- a. Information properly classified under criteria established by Executive Order.
- b. Information or regulatory issuances relating to internal personnel rules or practices.
- c. Matters that another statute specifically exempts from disclosure.
- d. Trade secrets or commercial or financial information received in confidence from outside the government.
- e. Internal advice, recommendations, and subjective evaluations pertaining to the decision-making process.
- f. Information in personnel or medical files.
- g. Investigative records compiled for enforcing civil, criminal, or military law.
- h. Information contained in or related to examination, operation or condition reports used by agencies responsible for the regulation or supervision of financial institutions.
- i. Certain geological and geophysical information and data concerning wells.

The DoD directive on the Freedom of Information Act states as its objective to: "Promote public trust by making the maximum amount of information available to the public on the operation and activities of the Department of Defense, consistent with DOD's responsibility to ensure national security". The DOD policy obviously promotes domestic technology transfer by "maximizing" the amount of information available to the public, but, on the other hand, it has compounded the technology export "control" problem.

From a control standpoint there has been no specific exemption that would permit the withholding of information (on unclassified technology with military application) upon request from any member of the public. "Member of the public" has been interpreted by the Attorney General to mean US citizens or foreign nationals, whether here or abroad. Once the information has been released to a requester, a public disclosure occurs, control is lost, and export may take place without the necessity of an export license. Thus, public release is tantamount to automatic export.

The "Department of Defense Authorization Act of 1984," P.L. 98-94, section 1217 has precipitated a draft DoD Directive 5400.XX, "Release of Technical Data to the Public." The law and this directive provide that technical data with military or space application may be withheld from public disclosure if it is subject to license requirements of the Export Administration Act or the Arms Export Control Act. Release of the data can be made to domestic US contractors with the advice that further dissemination or export may violate the law and will subject them to a fine and/or imprisonment.

## Industrial Independent Research and Development

Most defense contractors have their own additional "Independent Research and Development" (IR&D) program to increase technology expertise and improve their competitive edge.

Defense contractors formulate their own IR&D plan without any Government direction, coercion, or intimidation. The tasks selected by the contractor for an IR&D portfolio are the result of an analysis by the contractor of the market potential and a corporate decision to enter a new or expanding technology field. Government laboratory bench engineers and managers provide an input to industry by evaluating each task and providing a numerical score on relevance and accomplishment, and by providing written comments to the contractor. The Government's best input to industry is to provide cogent and clear statements of the service's need. Government engineers review and discuss the IR&D tasks at on-site reviews and by one-on-one technical discussions with the industrial bench engineers, each trying to influence the technical direction of the other but under obligation to protect the proprietary considerations until the technology is productized and marketed. In this technology transfer forum the entire "DoD community," Government and other industry, is eventually aware of the accomplishment.

The defense industry IR&D program is a significant portion of the national defense technology base, since typically it represents 8-10 times the level of DoD program element funding in basic research (6.1) and exploratory development (6.2). Elevation of the US technology

quotient is dependent on effective coordination and transfer of technology between the contractors' IR&D programs and the laboratories. Government engineers are in an ideal position to determine when and where duplication of effort exists between contractors and Government laboratories. In many cases duplication may be warranted if it produces competitive technical approaches to solve the same problem. This situation increases the probability of success. It is also to the advantage of the Government engineer to monitor industry in its application of "dual-use" technology. Many times commercialization of technology is accomplished before militarization.

## National Security Information Program

It is essential that the public be informed concerning the activities of its Government, but the interests of the United States and its citizens require that certain information concerning the national defense and foreign relations be protected against unauthorized disclosure. A Presidential executive order provides a uniform system for classifying, declassifying, and safeguarding national security information, which if disclosed, could reasonably be expected to cause damage to the national security.

Executive Order 12356 prescribes that Information shall be considered for classification if it concerns:

- (1) weapons,
- (2) the vulnerabilities or capabilities of national security systems,
- (3) foreign government information;
- (4) intelligence activities
- (5) foreign relations
- (6) scientific/technological information relating to the national security;
- (7) nuclear information
- (8) cryptology;
- (9) a confidential source; or
- (10) other categories of information that are related to the national security and that require protection against unauthorized disclosure

The executive order further specifies that information determined to concern one or more of the categories prescribed above and the release of which would be harmful to US interests shall be classified at one of the following three levels:

- "Top Secret" if the unauthorized disclosure could be expected to cause exceptionally grave damage to the national security.
- "Secret" if the unauthorized disclosure could be expected to cause serious damage to the national security.
- "Confidential" if the unauthorized disclosure could be expected to cause damage to the national security.

From a technology transfer point of view there is one exclusion that applies: "Basic scientific research information not clearly related to the national security may not be classified."

At the using level the Security Classification Guide prescribes (1) precisely the specific information elements to be protected, (2) their levels of classification, (3) the duration of classification, and (4) the action to be taken at the end of time in which the classification was effective.

The loss of unclassified technology with military application has been the center of concern since it has been the most readily available for a nominal cost and "legal" for acquisition by our Allies and potential adversaries. Information dealing with design and manufacturing know-how for military applicable technologies, but not considered to cause "direct" damage to national security, and therefore be classified, is released for public consumption by the Government laboratories. Additionally, unclassified Government technical documents limited to Government and Government contractors for various reasons were subject to release under Freedom of Information Act requests. Once the subject material was available to the public, it could be purchased by anyone from NTIS and exported without license requirements.

The previous system made no allowance for limiting unclassified technical information with significant military application.

In October 1983, Secretary of Defense Caspar W. Weinberger issued an "Interim Policy for Marking and Disseminating Defense Technical Documents." The memorandum states:

"The objective of establishing a system of controls (on technical data) in the Department and defense industry is to protect Defense technology, without incurring substantial cost and minimizing the impact on scientific innovation and the capability of defense industry to compete successfully in domestic and international markets."

It is anticipated the DoD Directive 5200.20, "Distribution Statements on Technical Documents," dated 24 September 1970, will be updated to reflect the new policy statement.

The "subject matter technical expert" must understand that a distribution statement marking is distinct from a security classification marking assigned in accordance with DoD Regulation 5200.1-R, "DoD Information Security Program Regulation."

A Distribution Statement is used in marking a technical document to denote the conditions and extent of its availability for distribution, release and disclosure without additional authorizations being needed.

Controlling DoD offices are responsible for determining the distribution limitation of each report, whether it is an in-house effort or contract/grant effort or whether the effort is classified or unclassified, based on technology criticality among other things. The Militarily Critical Technologies List (MCTL) is one such reference that can be used in making that determination.

The control of technology with significant military application has been significantly enhanced by the promulgation of the Secretary of Defense's policy on distribution limitations. But what about the consternation of the bench engineer and his supervisor when they are using the SCG and the MCTL to determine what information is classified, what information is unclassified -- critical technology, and what information is unclassified and suitable for "public release - distribution unlimited." An even more difficult job may be the preparation of the SCG's and submission of inputs on MCTL specific technologies. Where do you draw the lines between classified, unclassified militarily critical technology, and unclassified information?

Some general rules and common sense may be the most appropriate method. Considering only research, development and acquisition technical and program information, the following rules may be applied:

Rule 1: Consider Classifying This Information - Information relating to (1) performance and capabilities, (2) specifications, (3) vulnerabilities, (4) procurement and production plans and schedules, and (5) operations.

Rule 2: Consider Denoting This Information as Militarily Critical Technology - Information that specifically provides the "know-how" to design, fabricate, process, assemble, manufacture, and test military hardware and software.

Rule 3: Consider Maintaining This Information Unclassified and Applicable to "Public Release -- Distribution Unlimited" - Basic scientific and technical information developed in the Government laboratory, in the defense industry's R&D center, on IR&D, on contract, in the non-defense industry's engineering and manufacturing facility, and in the university research facility -- until the "state of emergence" is evident. (The transition from basic research (6.1) to exploratory development (6.2) with specific military application as denoted in Rule 2 above.)

## National Security by Accomplishment

The National Academy of Science panel on Scientific Communications and National Security sets forth the postulate that "Security by Accomplishments" is better than "Security through Secrecy," and that it represents a national strategy for long-term security through economic, technical, scientific and intellectual vitality.

A strategy of security by accomplishment has several institutional components. First, universities have the tasks of training new scientists and engineers and conducting basic research, the source of long-term progress. Second, government laboratories undertake research directed to particular national interests in defense, medicine, space, energy, and agriculture. Third, industry translates the results of research into new commercial and defense technology. It is important that all these institutions attain their full potential, for economic as well as for military reasons. Open scientific communication plays an important part in keeping scientists and engineers in Government, industry, and universities aware of each others' needs and findings.

Domestic technology transfer is enhanced in an open society. In the long run, the technological lead of the US is maintained through effective vigorous research and development and a conscious effort to prevent the undesirable export of critical military technologies. The active participation of the defense community personnel is the key to moderation and balance in the technology transfer controversy. That moderation and balance will contribute to the achievement of the desired technological leadtime.

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